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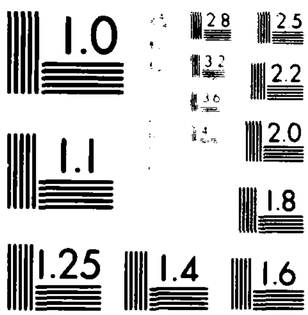

MICROCOPY RESOLUTION TEST CHART

TECHNICAL
MEMORANDUM
NOSC TM 541-82

MARCH 1982

BINOMIAL SEQUENTIAL TEST DESIGN FOR TESTING PROBABILITY OF AN EVENT

G. O. JONES

NOSC

NCSC TM 347-82

NAVAL COASTAL [illegible]

PANAMA CITY, FLORIDA [illegible]

CAPT RAYMOND D. BENNETT, USN
Commanding Officer

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A statistical test design is described to determine if the probability of an event is at a certain level. The procedure is illustrated by an example. A computer program for the test design is given. A table of 120 test designs is provided plus a table of sample sizes versus hypotheses.

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INTRODUCTION

In many tests of a manufactured item or system, performance is measured by the proportion of times that a favorable outcome is obtained. Often it is required to determine if a certain proportion of successes can be expected to occur in the long run. This report shows that a statistical test of hypotheses, called the binomial sequential test, can be used to make this decision. The purpose of this report is to describe the binomial sequential test design and to provide reference tables of test designs.

This report first describes the rationale for selecting the hypotheses of the binomial sequential test. Then it presents the equations of the acceptance/rejection regions of the test, the operating characteristic (OC) curve, and the average sample size curve. The test procedure is illustrated by the example

$$H_0: \quad P \leq 0.75 \ (\alpha_0 = 0.05)$$

$$H_1: \quad P \geq 0.95 \ (\alpha_1 = 0.05)$$

where P is the probability of an event E. Finally, this report presents the alternative method of estimating P by confidence intervals based on sample sizes of 5, 10, 20, 30, and 50 items.

Appendix A shows the derivation of the acceptance/rejection regions of the binomial sequential test. Appendix B documents a computer program for computing a test design for any set of hypotheses. Appendix C provides a table of 120 test designs, and Appendix D lists the hypotheses of Appendix C against their sample sizes.

PURPOSE OF THE BINOMIAL SEQUENTIAL TEST DESIGN

The binomial sequential test is applicable when items are being tested such that only two kinds of results are measured on each item: some event E either occurs or does not occur. For example, the outcome might be rated a success or failure, defective or non-defective, hit or miss. Event E can be designated to be either one of the two mutually exclusive outcomes. The proportion of times that E would occur for all the items is the probability of E.

The binomial sequential test design is called binomial because the outcomes can fall into only two classes, and it is called sequential because a decision is made after every successive observation. This test design is but a subset of a statistical method called the sequential probability ratio test developed by Abraham Wald in 1943 and described in Reference 1. Sequential test procedures are documented in the literature[2] for various kinds of probability density functions besides the binomial, such as the normal, Poisson, and exponential; this report will discuss only the case of the binomial.

The binomial sequential test design is the most efficient way of drawing a conclusion on whether the probability, P, of an event E is at some certain level, P*. The problem can be framed as trying to decide between the following hypotheses:

$$H_0: \ P \leq P^*$$

$$H_1: \ P > P^*.$$

Ideally, the decision function for these hypotheses would be as in Figure 1. A function, such as this one, which shows the probability of

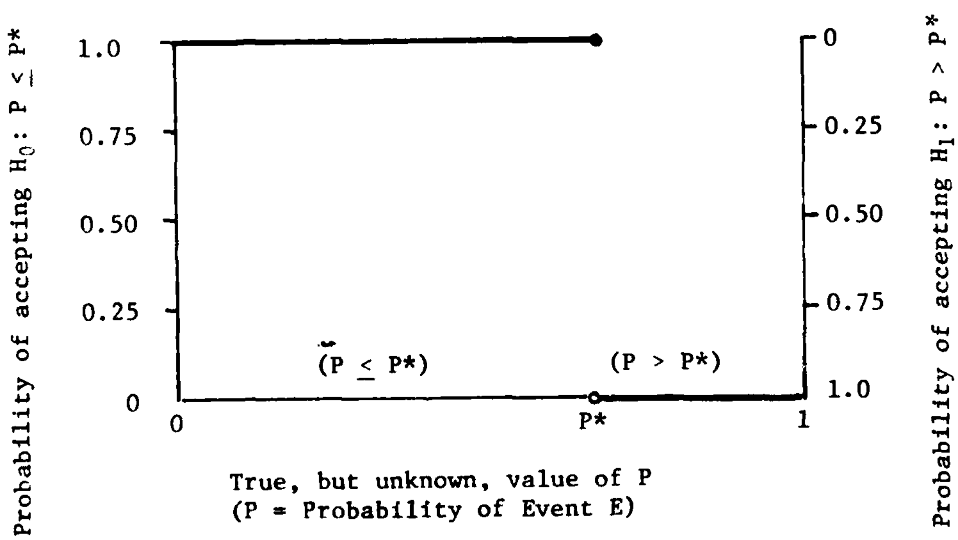

FIGURE 1. IDEAL OPERATING CHARACTERISTIC (OC) CURVE

[1]Wald, Abraham, Sequential Analysis, John Wiley & Sons, Inc., New York, 1947.

[2]Ostle, Bernard, Statistics in Research, Iowa State University Press, Ames, Iowa, 1963, p. 142.

accepting a hypothesis in a statistical test is called an operating characteristic (OC) curve. This OC curve is a function of the true but unknown value P, about which a decision is to be made. The ideal OC curve is discontinuous at P* because it represents the case in which the truth of H_0 or H_1 can be decided without any error. However, this would require testing every last item. A continuous OC curve that approximates the ideal OC curve can be established from only a random sample of the items.

Now, the larger the random sample, the closer the approximation can be made to the ideal OC curve; but it is also desired that the random sample be kept small. A sequential test can be used to make a compromise between the sample size and the OC curve. This test design gives the smallest sample size while the errors of the OC curve are held within certain bounds.

APPROXIMATING THE IDEAL OPERATING CHARACTERISTIC CURVE

First, requirements are set concerning how close an approximation is needed to the ideal OC curve. This is done essentially by replacing P* by different values in H_0 and H_1,

$$H_0: \quad P \leq P_0$$

$$H_1: \quad P \geq P_1,$$

and by choosing values for the OC curve at P_0 and P_1. P_0 and P_1 are points relatively close to P*. The idea is to control the ends of the OC curve in the regions where it is most important to make a correct decision concerning the true value of P. These are the regions $P \leq P_0$ and $P \geq P_1$. The region $P_0 < P < P_1$ is called the region of indifference. A typical approximation function is shown in Figure 2.

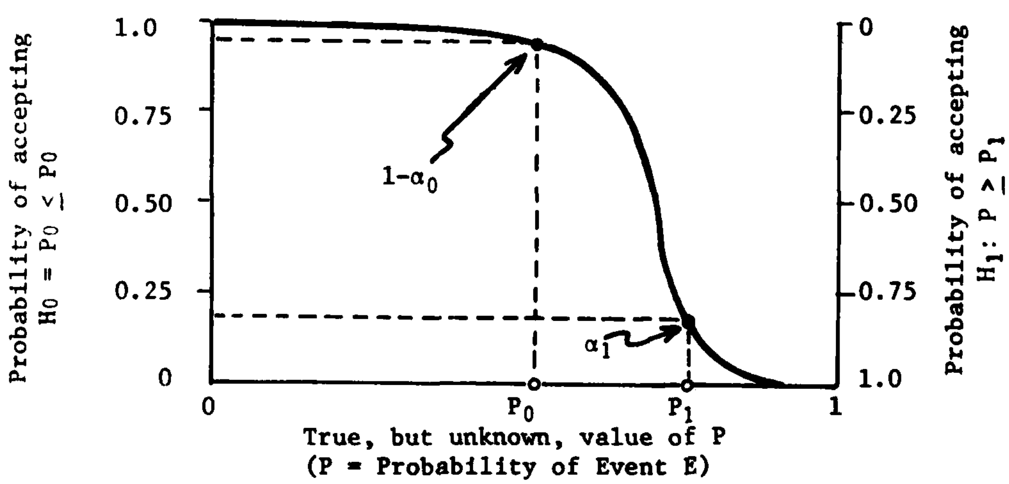

FIGURE 2. OPERATING CHARACTERISTIC CURVE FROM A RANDOM SAMPLE

In this figure, the values of the OC curve at P_0 and P_1 are $1-\alpha_0$ and α_1 (on the left-hand scale). These values are determined by the selection of α_0 and α_1, which are an integral part of the hypotheses H_0 and H_1, and which represent the maximum risks of rejecting the corresponding hypothesis when it is true. The risks α_0 and α_1 are small positive numbers, less than 1.

SELECTION OF HYPOTHESES

The rationale for selecting the hypotheses about P, the probability of an event E, can be summarized as follows. Two hypotheses* are stated about P, with associated risks of error:

H_0: $P \leq P_0$ (α_0 = Maximum risk of rejecting H_0 when it is true)

H_1: $P \geq P_1$ (α_1 = Maximum risk of rejecting H_1 when it is true).

Either H_0 or H_1 will be accepted on the basis of a random sample. The separation between P_0 and P_1 and the size of α_0 and α_1 determine how closely the OC curve based on the random sample will approximate the ideal OC curve. Obviously, the approximation gets better as P_0 and P_1 get closer and α_0 and α_1 get smaller. At the same time, the average sample size required to make a decision also depends on these parameters. The general principle of sample size is that it becomes smaller as P_0 and P_1 move farther apart or the risks α_0 and α_1 become greater; and it is larger as P_0 and P_1 are closer or α_0 and α_1 are smaller. The choice of the hypotheses, then, is a balancing act of sample size against how close an approximation is needed to the ideal OC curve. This determination depends on the circumstances of the particular test situation.

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*In the statistical literature, the procedure is described as testing the simple hypotheses (containing equality signs)

H_0: $P = P_0$ (α_0 = Risk of rejecting H_0 when it is true)

H_1: $P = P_1$ (α_1 = Risk of rejecting H_1 when it is true)

instead of the composite hypotheses (containing inequality signs) considered in this report. The test of composite hypotheses is the true problem of interest; Wald[1] states that the test of the simple hypotheses provides a satisfactory solution to the test of composite hypotheses.

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[1]ibid, p. 79

ACCEPTANCE/REJECTION REGIONS

After selection of the hypotheses, the acceptance/rejection regions can be determined. The acceptance/rejection regions are rules for deciding, from the random sample, whether H_0 or H_1 is to be accepted and the other hypothesis rejected. The sequential test minimizes the sample size required to make a decision because it tells the user when he can stop testing.

The acceptance/rejection regions are computed by a comparison of the probabilities, after each item is tested, of obtaining the number of outcomes that have fallen in E if $P = P_0$ or if $P = P_1$. The derivation of the acceptance/rejection regions can be found in Appendix A, but the rules defining these regions are summarized in Table 1. These criteria are applied after each item is tested.

TABLE 1

ACCEPTANCE/REJECTION REGIONS

To Test:

H_0: $P \leq P_0$ (α_0 = Maximum risk of rejecting H_0 if H_0 is true)

H_1: $P \geq P_1$ (α_1 = Maximum risk of rejecting H_1 if H_1 is true)

(where $P_0 < P_1$).

Accept H_0 and Reject H_1 if:

$$N(E) \leq \frac{\ln\left(\frac{\alpha_1}{1-\alpha_0}\right)}{\ln\left(\frac{P_1}{P_0}\right)} + N(\sim E)\left[\frac{-\ln\left(\frac{1-P_1}{1-P_0}\right)}{\ln\left(\frac{P_1}{P_0}\right)}\right].$$

Accept H_1 and Reject H_0 if:

$$N(E) \geq \frac{\ln\left(\frac{1-\alpha_1}{\alpha_0}\right)}{\ln\left(\frac{P_1}{P_0}\right)} + N(\sim E)\left[\frac{-\ln\left(\frac{1-P_1}{1-P_0}\right)}{\ln\left(\frac{P_1}{P_0}\right)}\right].$$

Otherwise, Continue Testing.

NOTE: (N(E) = number of outcomes in E; N(~E) = number of outcomes not in E; ln = natural logarithm.

The rules in Table 1 can be represented by a pair of parallel lines, which makes application of the decision rules a very simple graphical procedure. This will be shown, shortly, by an example.

OPERATING CHARACTERISTIC CURVE

The probability of accepting a particular hypothesis about P is a function of the true value of P. This function is the OC curve for that hypothesis. The OC curve for H_0 can be sketched from five points. These points are given in Table 2.

TABLE 2

FIVE VALUES OF THE OPERATING CHARACTERISTIC CURVE FOR H_0

True P	Probability of Accepting H_0: $P = P_0$
0	1
P_0	$1-\alpha_0$
$P' = \dfrac{\ln((1-P_1)/(1-P_0))}{\ln((1-P_1)/(1-P_0)) - \ln(P_1/P_0)}$	$\dfrac{\ln((1-\alpha_1)/\alpha_0)}{\ln((1-\alpha_1)/\alpha_0) - \ln(\alpha_1/(1-\alpha_0))}$
P_1	α_1
1	0

The values of the OC curve at $P = 0$ and $P = 1$ are determined by the assumption that $P_0 < P_1$; the values of the OC curve at P_0 and P_1 are determined by the selection of the risks α_0 and α_1. The point P' and the value of the OC curve at P' are computed from the theory of the binomial sequential test design.[3] If α_0 and α_1 are chosen to be equal, the value of the OC curve at P' simplifies to 0.50; e.g., in the OC curves of Appendix C.

From the OC curve for H_0, the OC curve for the other hypothesis, H_1, is automatically determined. Because the test of hypotheses implies that

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[3]Dixon, W. J. and Massey, F. J., Introduction to Statistical Analysis, Second Edition, McGraw-Hill Book Company, Inc., New York, 1957.

either one hypothesis or the other is accepted, the OC curve for H_1 is the complement of the OC curve for H_0. That is,

$$\text{Probability (accept } H_1) = 1 - \text{Probability (accept } H_0)$$

over all values of P. This relationship has already been indicated in Figures 1 and 2 by the left and right vertical scales.

AVERAGE SAMPLE SIZE CURVE

For a given set of hypotheses the average sample size is, like the OC curve, a function of P. The curve showing the average sample size that will be required to reach a conclusion can be sketched from five known points. Table 3 gives these points. P' here is the same as in Table 2; the maximum average sample size occurs when P = P'.

TABLE 3

FIVE VALUES OF AVERAGE SAMPLE SIZE CURVE

True P	Average Sample Size
0	$\dfrac{\ln (\alpha_1/(1-\alpha_0))}{\ln ((1-P_1)/(1-P_0))}$
P_0	$\dfrac{(1-\alpha_0) \ln (\alpha_1/(1-\alpha_0)) + \alpha_0 \ln ((1-\alpha_1)/\alpha_0)}{P_0 \ln (P_1/P_0) + (1-P_0) \ln ((1-P_1)/(1-P_0))}$
P'	$\dfrac{\ln (\alpha_1/(1-\alpha_0)) \ln ((1-\alpha_0)/\alpha_0)}{\ln (P_1/P_0) \ln ((1-P_0)/(1-P_0))}$
P_1	$\dfrac{\alpha_1 \ln (\alpha_1/(1-\alpha_0)) + (1-\alpha_1) \ln ((1-\alpha_1)/\alpha_0)}{P_1 \ln (P_1/P_0) + (1-P_1) \ln ((1-P_1)/(1-P_0))}$
1	$\dfrac{\ln ((1-\alpha_1)/\alpha_0)}{\ln (P_1/P_0)}$

When these values of average sample size are computed, they are not necessarily integers because the average is an idealistic number over a long series of sequential tests. For practical interpretation, a fractional average may be rounded up to the next integer.

AN EXAMPLE

To illustrate the binomial sequential test design, an example will be given for which the sample size is fairly small (maximum expected: 23). Still the P_0 and P_1 values and the risks have been chosen such that the test can determine if the probability of an event E is at a high level.

HYPOTHESES

The following hypotheses are considered:

H_0: $P = P_0 \leq 0.75$

($\alpha_0 = 0.05$ maximum risk of rejecting H_0 if H_0 is true),

H_1: $P = P_1 \geq 0.95$ 1

($\alpha_1 = 0.05$ maximum risk of rejecting H_1 if H_1 is true).

ACCEPTANCE/REJECTION REGIONS

The acceptance/rejection regions for these hypotheses are defined by the following equations:

If $N(E) \leq -12.5 + 6.8 * N(\sim E)$, accept H_0 and reject H_1.

If $N(E) \geq 12.5 + 6.8 * N(\sim E)$, accept H_1 and reject H_0.

While N(E) lies between these two lines, continue testing. Here, N(E) = number of outcomes in E; N($\sim$E) = number of outcomes not in E. The graphical presentation of the acceptance/rejection regions is given in Figure 3.

TEST PROCEDURE

The test procedure, using Figure 3, is as follows. Test an item. In the figure, plot whether the outcome was in E or not in E. Continue plotting the number of outcomes in E or not in E, as they occur, in a stepwise manner on this graph until the plot breaks through one of the parallel lines. This leads to acceptance of the hypothesis in that region. Continue testing as long as the plot is between the parallel lines. Each test must be independent of the preceding tests.

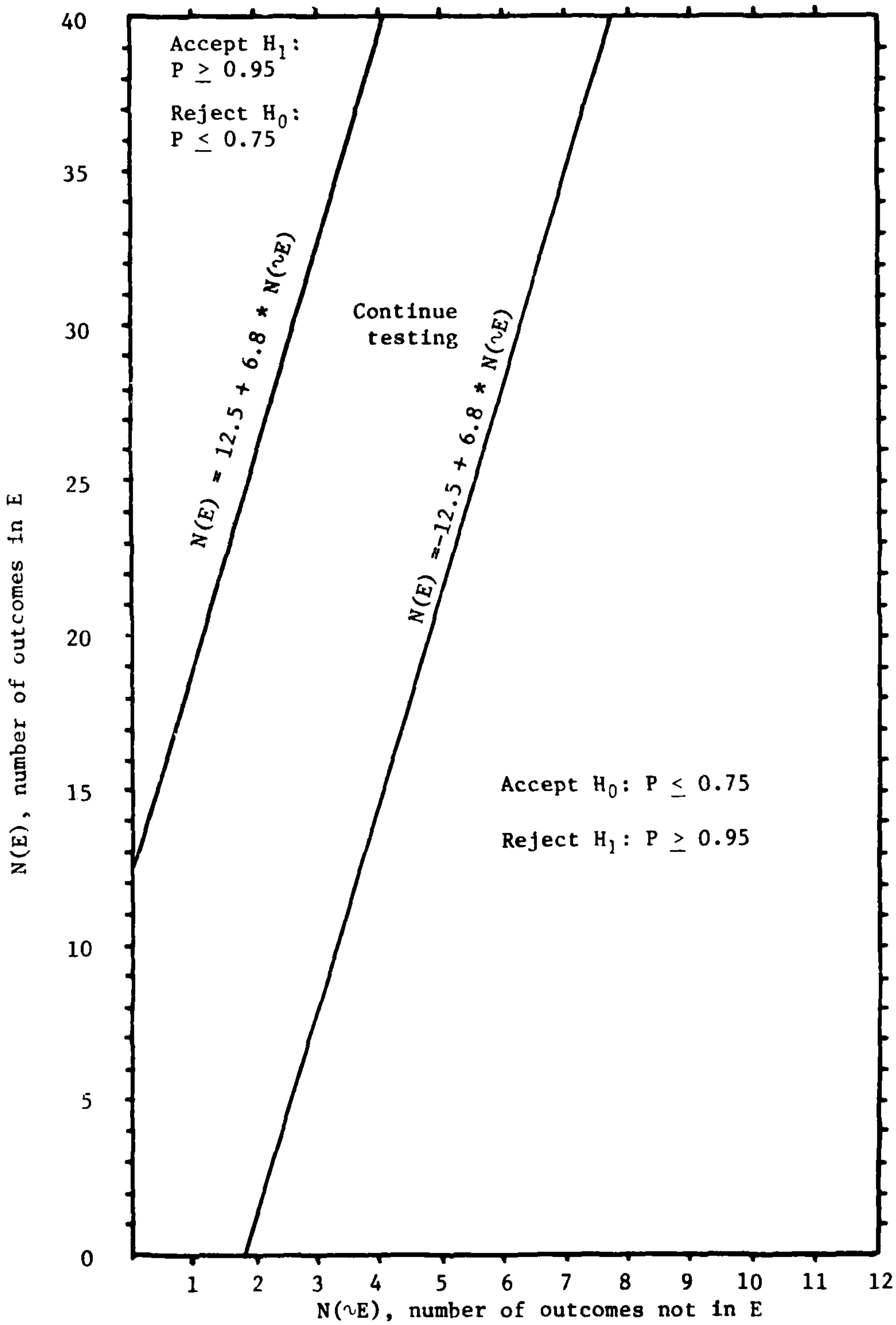

FIGURE 3. ACCEPTANCE/REJECTION REGIONS FOR H_0: $P \leq 0.75$ ($\alpha_0 = 0.05$) VERSUS H_1: $P \geq 0.95$ ($\alpha_1 = 0.05$)

SAMPLE SIZES

It can be seen from Figure 3 that two successive outcomes not in E will immediately lead to acceptance of H_0: $P \leq 0.75$. Also, Figure 3 shows that 13 successive outcomes in E will lead to acceptance of H_1: $P \geq 0.95$. These are the minimum sample sizes to draw a conclusion on H_0 or H_1.

The average sample size to draw a conclusion is a function of the true but unknown value of P. Figure 4 is the graph of average sample size versus P. The curve was sketched from the five points in Table 3 by substitution of $P_0 = 0.75$, $P_1 = 0.95$, $\alpha_0 = 0.05$, and $\alpha_1 = 0.05$.* If P is 0.95, an expected sample size of 19 tests will be performed to reach a conclusion. If P is 0.75, the expected sample size is 12 tests. The maximum average number of tests occurs if P is 0.872; then, the expected sample size to draw a conclusion is 23 tests.

OPERATING CHARACTERISTIC CURVE

Figure 5 shows the operating characteristic curve for this test, i.e., the probability of accepting a particular hypothesis, as a function of P, sketched from the five points in Table 2.* The probability of accepting a particular hypothesis means the relative frequency of accepting it over a very large number of sequential tests. The left and right scales in Figure 5 are the complements of each other. The curve shows that if the true value of P is less than or equal to 0.75, there is at least 95 percent probability that H_0 will be accepted; and if the true value of P is greater than or equal to 0.95, there is at least 95 percent probability that H_1 will be accepted. These probabilities are directly related to the size of the risks, α_0 and α_1. The risks α_0 and α_1 should be small; 0.05 is a standard value and was chosen for this design. If P = 0.872, there is a 50 percent probability of accepting H_0 and a 50 percent probability of accepting H_1. It is possible to make a finer distinction than given in this example for a true value of P less than, but close to, 0.95 by choosing P_0 closer to P_1 and keeping α_0 and α_1 small; but this will result in a significantly larger sample size.

COMPUTER PROGRAM

A computer program has been written in FORTRAN on the B6810 computer for the equations of the binomial sequential test. The inputs are P_0, P_1, α_0, and α_1 under the hypotheses H_0 and H_1. The outputs are the computed results of Tables 1, 2, and 3. The computer program is documented in Appendix B.

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*The exact calculated values of Tables 2 and 3 for this example are shown in Table C26 of Appendix C.

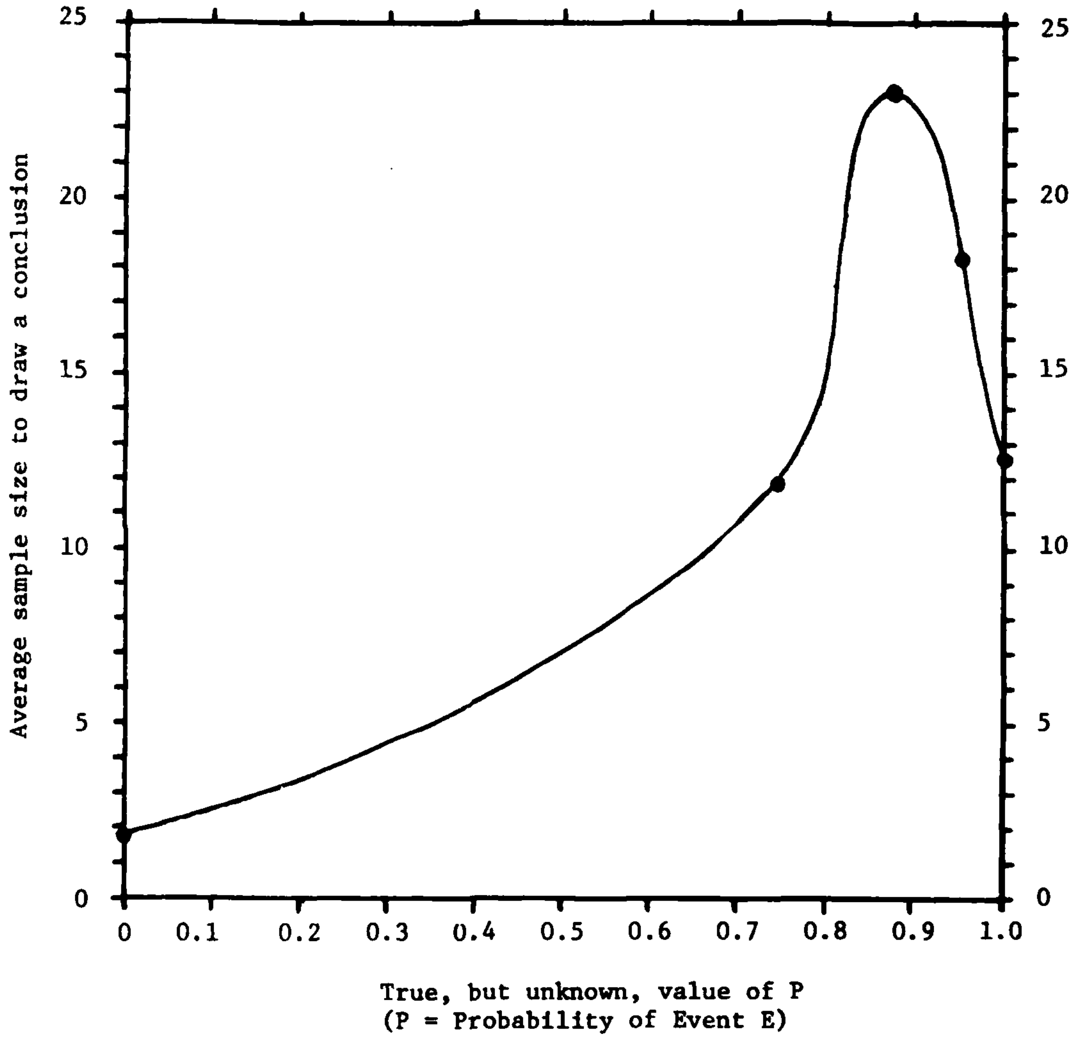


FIGURE 4. AVERAGE SAMPLE SIZE CURVE FOR H_0: $P \leq 0.75$ ($\alpha_0 = 0.05$) VERSUS H_1: $P \geq 0.95$ ($\alpha_1 = 0.05$)

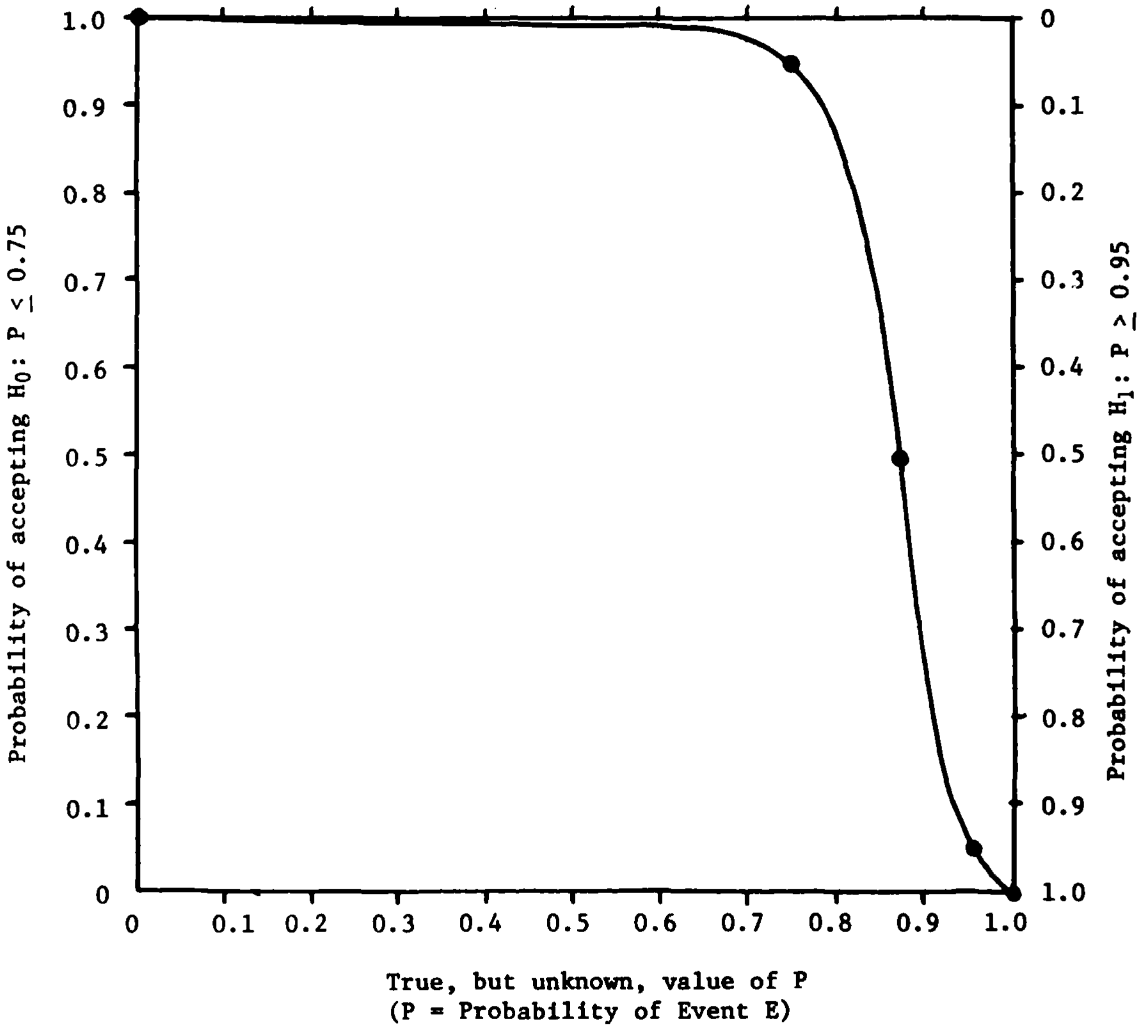


FIGURE 5. OPERATING CHARACTERISTIC CURVE FOR H_0: $P \leq 0.75$ ($\alpha_0 = 0.05$) VERSUS H_1: $P \geq 0.95$ ($\alpha_1 = 0.05$)

OTHER SETS OF HYPOTHESES

Test designs for 120 sets of hypotheses are presented in Tables C1 through C30 of Appendix C. The hypotheses range from $P \leq 0.10$ versus $P \geq 0.20$ to $P \leq 0.95$ versus $P \geq 0.99$. The acceptance/rejection regions can be plotted as in Figure 3; the table of average sample sizes can be plotted as in Figure 4; and the probability of accepting H_0 (the OC curve) can be plotted as in Figure 5. Appendix D lists the hypotheses against their sample sizes to make it easier to consider just the sample sizes when selecting a test design. Table D1 shows the effect on sample sizes as P_0 and P_1 are brought closer together or as α_0 and α_1 decrease.

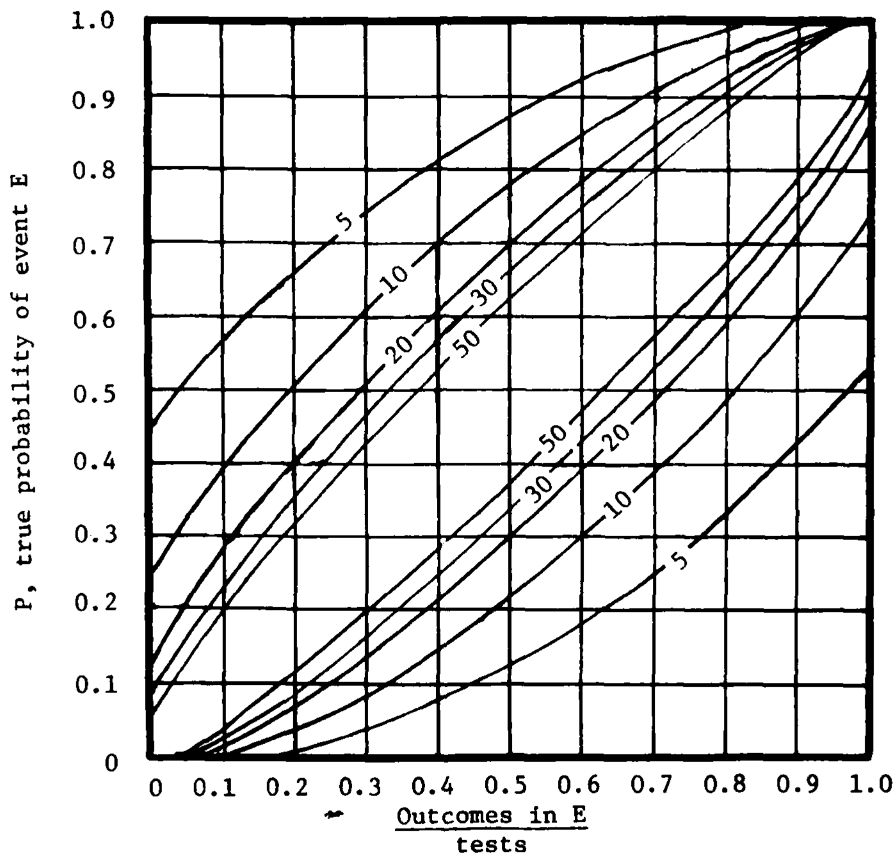
CONFIDENCE BOUNDS ON P

The binomial sequential test of hypotheses is the most efficient way of determining whether P, the probability of an event E, is achieving a certain level. Another method of interpreting the test results is just to make a confidence interval statement about P.

Figure 6 presents confidence intervals on P for sample sizes of 5, 10, 20, 30, and 50 tests. The intervals for this graph have 90 percent confidence if they are two-sided; there is 95 percent confidence if just a lower bound on P is asserted.

Use of this figure is described. A test is performed a certain number of times. The number of outcomes in E are counted. The ratio of outcomes in E to tests is found on the horizontal axis. A perpendicular line is constructed at this point. It intersects the two curved lines representing the sample size. The confidence limits on P are read from the vertical scale at the two points of intersection. A two-sided confidence interval on P is composed of both lower (L) and upper (U) bounds; it says that there is 90 percent confidence that the true value of P lies in the interval (L,U). A one-sided lower confidence bound on P asserts that there is 95 percent confidence that the true value of P is $\geq$ L. For many tests, only the lower bound is of real interest.

This procedure is illustrated by the following example. Suppose a test is performed 30 times with 20 outcomes in E. The observed ratio of outcomes in E to tests is $20/30 \simeq 0.66$. The number 0.66 is located on the horizontal axis. At the intersection with the curved lines for 30 tests, the lower and upper bounds are 0.48 and 0.80. Therefore, there is 90 percent confidence that P lies in the interval (0.48, 0.80); alternatively, there is 95 percent confidence that $P \geq 0.48$.



(5, 10, 20, 30, 50 = number of tests)

Taken from Reference 3

FIGURE 6 . CONFIDENCE BOUNDS ON P

APPENDIX A

DERIVATION OF ACCEPTANCE/REJECTION REGIONS

APPENDIX A

DERIVATION OF ACCEPTANCE/REJECTION REGIONS

This appendix shows how the acceptance/rejection regions in Table 1 of the report are derived. The hypotheses to be tested are the composite hypotheses

H_0: $P \leq P_0$ (α_0 = maximum risk of rejecting H_0 when H_0 is true)

H_1: $P \geq P_1$ (α_1 = maximum risk of rejecting H_1 when H_1 is true).

The solution for deciding between these hypotheses is given by the solution for the simple hypotheses

H_0: $P = P_0$ (α_0 = risk of rejecting H_0 when H_0 is true)

H_1: $P = P_1$ (α_1 = risk of rejecting H_1 when H_1 is true)

$(P_0 < P_1)$.

This solution is described below; it is based primarily on Reference A1.

The acceptance/rejection regions for the binomial sequential test design are derived from a likelihood ratio test. If the probability of an event E is P, then the probability of getting N outcomes in E and m-N outcomes not in E, in some particular order, in m trails, is

$$P^N (1 - P)^{m-N} \quad .$$

This probability is called a likelihood function.

Now, the object of the test of simple hypotheses is to discriminate between two possible values of P, P_0, and P_1, given that

$$0 < P_0 < P_1 < 1.$$

[A1] Johnson, Norman L. and Leone, Fred C., Statistics and Experimental Design, Volume II, John Wiley & Sons, Inc., New York, 1964, pp. 243-249.

The likelihood function if $P = P_0$ is

$$P_0^N (1 - P_0)^{m-N} \;;$$

if $P = P_1$, it is

$$P_1^N (1 - P_1)^{m-N} \;.$$

The likelihood ratio is

$$\frac{P_1^N (1 - P_1)^{m-N}}{P_0^N (1 - P_0)^{m-N}} \;.$$

The size of this ratio will be considered to determine when H_0 or H_1 is to be accepted. When this ratio gets so small as to be less than some certain number, A,

$$\frac{P_1^N (1 - P_1)^{m-N}}{P_0^N (1 - P_0)^{m-N}} \leq A,$$

then it is decided that H_0: $P = P_0$ is more reasonable to accept than H_1: $P = P_1$. On the other hand, when the ratio is so large as to be greater than some certain number, B,

$$\frac{P_1^N (1 - P_1)^{m-N}}{P_0^N (1 - P_0)^{m-N}} \geq B,$$

then H_1: $P = P_1$ is more reasonable to accept than H_0: $P = P_0$. As long as

$$A \leq \frac{P_1^N (1 - P_1)^{m-N}}{P_0^N (1 - P_0)^{m-N}} \leq B$$

no conclusion is made, and another sample is taken.

It is shown in the statistical literature[A1 A2] that, for the given risks α_0 and α_1, appropriate values of A and B are

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[A1] ibid.

[A2] Wald, Abraham, Sequential Analysis, John Wiley & Sons, Inc., New York, 1947.

$$A = \frac{\alpha_1}{1-\alpha_0}$$

and

$$B = \frac{1-\alpha_1}{\alpha_0} \quad .$$

Hence, the acceptance region for H_0 (rejection region for H_1) is

$$\frac{P_1^N \; (1-P_1)^{m-N}}{P_0^N \; (1-P_0)^{m-N}} \le \frac{\alpha_1}{1-\alpha_0} \quad ;$$

and the acceptance region for H_1 (rejection region for H_0) is

$$\frac{P_1^N \; (1-P_1)^{m-N}}{P_0^N \; (1-P_0)^{m-N}} \ge \frac{1-\alpha_1}{\alpha_0} \quad .$$

These can be reduced to give the formulae in Table 1 as shown below.

ACCEPTANCE REGION FOR H_0

$$\left(\frac{P_1}{P_0}\right)^N \left(\frac{1-P_1}{1-P_0}\right)^{m-N} \le \frac{\alpha_1}{1-\alpha_0}$$

$$N \ln (P_1/P_0) + (m-N) \ln ((1-P_1)/(1-P_0)) \le \ln (\alpha_1/(1-\alpha_0))$$

$$N \le \frac{\ln (\alpha_1/(1-\alpha_0))}{\ln (P_1/P_0)} + (m-N) \left[\frac{-\ln ((1-P_1)/(1-P_0))}{\ln (P_1/P_0)}\right] \quad .$$

N, the number of outcomes in E, can be written as N(E), and m-N, the number of outcomes not in E, as N(~E). Therefore the decision to accept H_0 is made when

$$N(E) \le \frac{\ln(\alpha_1/(1-\alpha_0))}{\ln(P_1/P_0)} + N(\sim E) \left[\frac{-\ln((1-P_1)/(1-P_0))}{\ln(P_1/P_0)}\right] . \qquad \text{(A1)}$$

ACCEPTANCE REGION FOR H_1

$$\left(\frac{P_1}{P_0}\right)^N \left(\frac{1-P_1}{1-P_0}\right)^{m-N} \ge \frac{1-\alpha_1}{\alpha_0}$$

$$N \ln (P_1/P_0) + (m-N) \ln ((1-P_1)/(1-P_0)) \ge \ln ((1-\alpha_1)/\alpha_0)$$

$$N \geq \frac{\ln((1-\alpha_1)/\alpha_0)}{\ln(P_1/P_0)} + (m-N)\left[\frac{-\ln((1-P_1)/(1-P_0))}{\ln(P_1/P_0)}\right]$$

$$N(E) \geq \frac{\ln((1-\alpha_1)/\alpha_0)}{\ln(P_1/P_0)} + N(\sim E)\left[\frac{-\ln((1-P_1)/(1-P_0))}{\ln(P_1/P_0)}\right]. \tag{A2}$$

The assumption $0 < P_0 < P_1 < 1$ makes $\ln(P_1/P_0)$ positive, which preserves the direction of the $\leq$ and $\geq$ signs when $\ln(P_1/P_0)$ is used as a divisor. The two lines [Equations (A1) and A2)] defining the acceptance regions are parallel because they have the same slope. In the special case that α_0 and α_1 are chosen to be equal, the first term on the right-hand side of Equation (A1) is the negative of that in Equation (A2); this condition holds for all the acceptance regions of Appendix C.

APPENDIX B

COMPUTER PROGRAM FOR BINOMIAL SEQUENTIAL TEST

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COMPUTER PROGRAM FOR BINOMIAL SEQUENTIAL TEST

INTRODUCTION

This computer program computes the acceptance/rejection regions for the binomial sequential test (refer to Table 1 in the report), five values of the operating characteristic curve (Table 2), and five values of the average sample size curve (Table 3). The purpose of the program is to allow the reader to quickly calculate test designs for various hypotheses and then choose one appropriate to his requirements of sample size and OC curve if it is necessary to go beyond the scope of the tables in Appendices C and D.

The program is written in FORTRAN for use through a terminal. The program reads a list of input data from a disk file and writes the output on another disk file. The purpose of this arrangement is to allow many sets of hypotheses to be computed per run of the program and the long output file to be written later on the line printer.

The program listing in Figure B1 is self-documenting. A sample program run, including input file and output file, is shown in Figure B2.

USING THE PROGRAM

In order to use this program, the user must have it stored on disk under his user code and identified by a program name; e.g., BST. The user must create an input file on disk in which he lists the parameters of the hypotheses he wants to test. The input file must be titled BST/IN. It is created by the CANDE command MAKE BST/IN, and the file type is automatically assigned to be SEQ. On each line of file BST/IN the numerical values of P_0, P_1, α_0, α_1 are listed in the following format: N P_0, P_1, α_0, α_1. N is the line number; P_0 and P_1 are subject to the restriction $0 < P_0 < P_1 < 1$; the restrictions on α_0 and α_1 are $0 < \alpha_0 < 1$ and $0 < \alpha_1 < 1$. This format is illustrated by the input file in Figure B2. The file BST/IN is then saved on disk by SAVE.

The user calls up the program BST by the CANDE command GET BST and executes it by the command RUN. As the program runs, it reads a line of input data from BST/IN, computes the test design, and writes the output on

```
$RESET FREE
FILE  1(KIND=DISK,TITLE="BST/IN",FILETYPE=7)
FILE  2(KIND=DISK,TITLE="BST/OUT",NEWFILE=TRUE,PROTECTION=SAVE)
C ******************************************************************
C THIS PROGRAM COMPUTES OPERATING CHARACTERISTIC CURVE, AVERAGE
C SAMPLE SIZE CURVE, AND ACCEPTANCE/REJECTION REGIONS FOR THE
C BINOMIAL SEQUENTIAL TEST DESIGN.
C ******************************************************************
C LOOP TO READ THE FOUR INPUT PARAMETERS FOR EACH SET OF HYPOTHESES.
C I IS A COUNTER OF NUMBER OF SETS OF HYPOTHESES.  I IS PRINTED ON THE
C TERMINAL AFTER EACH TEST DESIGN IS CALCULATED.
      INTEGER I
      I=1
   50 READ(1,/,END=800)P0,P1,A0,A1
C ******************************************************************
C VARIABLES USED IN THE CALCULATIONS
      REAL P0,P1,A0,A1,PPR
      REAL B0,H0,B1,H1
      REAL N1,N2,N3,N4
      N1=ALOG((1.0-P1)/(1.0-P0))
      N2=ALOG(P1/P0)
      N3=ALOG((1.0-A1)/A0)
      N4=ALOG(A1/(1.0-A0))
C FIVE VALUES ON OPERATING CHARACTERISTIC CURVE
      REAL PACC0,PACCP0,PACPPR,PACCP1,PACC1
C FIVE VALUES ON AVERAGE SAMPLE SIZE CURVE
      REAL SS0,SSP0,SSPPR,SSP1,SS1
C ******************************************************************
C COMPUTE PROBABILITY OF ACCEPTING H0 FOR P= 0,P0,P*,P1,1
      PACC0=1.0
      PACCP0=1.0-A0
      PPR=N1/(N1-N2)
      PACPPR=N3/(N3-N4)
      PACCP1=A1
      PACC1=0.
C ******************************************************************
C COMPUTE AVERAGE SAMPLE SIZES FOR P= 0,P0,P*,P1,1
      SS0=N4/N1
      SSP0=((1.0-A0)*N4+A0*N3)/(P0*N2+(1.0-P0)*N1)
      SSPPR=(N4*N3)/(N2*N1)
      SSP1=(A1*N4+(1.0-A1)*N3)/(P1*N2+(1.0-P1)*N1)
      SS1=N3/N2
C ******************************************************************
```

FIGURE B1. COMPUTER PROGRAM FOR BINOMIAL SEQUENTIAL TEST
(Sheet 1 of 2)

```
      C COMPUTE INTERCEPTS B0,B1 AND SLOPES M0,M1 OF THE ACCEPTANCE/
      C REJECTION LINES
            B0=N4/N2
            M0=-N1/N2
            B1=N3/N2
            M1=-N1/N2
      C ******************************************************************
      C PRINT OUT RESULTS
            WRITE(2,500)
        500 FORMAT(72('-'))
            WRITE(2,520)P0,A0
        520 FORMAT(T24,'H0:P=P0= ',F4.3,5X,'(A0= ',F4.3,')')
            WRITE(2,530)P1,A1
        530 FORMAT(T24,'H1:P=P1= ',F4.3,5X,'(A1= ',F4.3,')')
            WRITE(2,550)
        550 FORMAT(/,7X,'TRUE VALUE OF P',7X,' PROB ACCEPT P=P0',
           +8X,'SAMPLE SIZES')
            WRITE(2,560)0.0,PACC0,SS0
        560 FORMAT( 9X,'P    = ',I4,16X,I5,16X,F7.2)
            WRITE(2,570)P0,PACCP0,SSP0
        570 FORMAT(9X,'P0  = ',F4.3,16X,F5.3,16X,F7.2)
            WRITE(2,580)PPR,PACPPR,SSPPR
        580 FORMAT(9X,6HP'   =  ,F4.3,16X,F5.3,16X,F7.2)
            WRITE(2,590)P1,PACCP1,SSP1
        590 FORMAT(9X,'P1  = ',F4.3,16X,F5.3,16X,F7.2)
            WRITE(2,600)1.0,PACC1,SS1
        600 FORMAT(9X,'P    = ',I4,16X,I5,16X,F7.2)
            WRITE(2,620)B0,M0
        620 FORMAT(/,4X,'N(E) <= ',F8.3,2X,'+',2X,F8.3,8H * N(E'),6X
           +'(ACCEPT H0, REJECT H1)')
            WRITE(2,630)B1,M1
        630 FORMAT(4X,'N(E) >= ',F8.3,2X,'+',2X,F8.3,8H * N(E'),6X
           +'(ACCEPT H1, REJECT H0)')
      C ******************************************************************
      C A COUNT IS MADE ON THE TERMINAL OF THE NUMBER OF TEST DESIGNS COMPUTED
            IF (I .GT. 1) GO TO 650
            WRITE(6,640)
        640 FORMAT(' NUMBER OF HYPOTHESES TESTED:')
        650 WRITE(6,700)I
        700 FORMAT(3X,I4)
            I=I+1
            GO TO 50
        800 STOP
            END
```

FIGURE B1. (Sheet 2 of 2)

```
MAKE BST/IN
#WORKFILE BST/IN:  SEQ
100 .1, .2, .01, .05


#
SAVE
#UPDATING
#WORKSOURCE BST/IN SAVED
GET BST
#WORKFILE BST: FORTRAN, 87 RECORDS, SAVED
#OBJECT FILE PRESENT, SAVED
RUN
#RUNNING 9964
#9964 (GLYNN)BST/OUT REMOVED ON DISK PK80.


NUMBER OF HYPOTHESES TESTED:
       1
#ET=6.9 PT=0.4 IO=1.5
GET BST/OUT
#WORKFILE BST/OUT: DATA, 13 RECORDS, SAVED
LIST
100---------------------------------------------------------------------------
200                      HO:P=PO= .100  (AO= .010)
300                      H1:P=P1= .200  (A1= .050)
400
500            TRUE VALUE OF P       PROB ACCEPT P=PO       SAMPLE SIZES
600                 P  =    0                1                  25.35
700                 PO = .100              0.990                79.32
800                 P' = .145              0.604               166.54
900                 P1 = .200              0.050                94.07
1000                P  =    1                0                   6.57
1100
1200   N(E)  <=.-4.307  +   0.170 * N(E')  (ACCEPT HO, REJECT H1)
1300   N(E)  >=  6.570  +   0.170 * N(E')  (ACCEPT H1, REJECT HO)
#
SAVE AS BST/OUT/ONE
#WORKSOURCE BST/OUT SAVED AS (GLYNN)BST/OUT/ONE ON DISK
```

FIGURE B2. SAMPLE RUN OF COMPUTER PROGRAM

a file BST/OUT on disk created by the program. BST/OUT is a type DATA file. After each test design is computed, a count is printed on the terminal to indicate to the user the progress of the job. The program stops when the list of input data is exhausted.

The output file BST/OUT is retrieved by the CANDE command GET BST/OUT. This file can then be viewed on the terminal by the command LIST; or it can be written on the line printer by the command WRITE BST/OUT. Using the line printer is convenient if the output file is lengthy. Every time the program is run, the old file BST/OUT will be replaced by a new one. If the old file is to be saved, it must be saved under a different name; e.g., SAVE AS BST/OUT/ONE.

A SAMPLE RUN

These steps are illustrated by Figure B2, a printout from a computer terminal of a program run. There is only one line of input data in this run. This example replicates a problem on pages 305-310 of Reference B1.

[B1] Dixon, W. J. and Massey, F. J., Introduction to Statistical Analysis, Second Edition, McGraw-Hill Book Company, Inc., New York, 1957.

APPENDIX C

TABLES OF BINOMIAL SEQUENTIAL TEST DESIGNS

APPENDIX C

TABLES OF BINOMIAL SEQUENTIAL TEST DESIGNS

This appendix is intended to provide a handbook of sequential test designs. Tables C1 through C30 contain 120 test designs generated by the computer program in Appendix B. For each set of hypotheses, five values of the OC curve, five values of the sample size curve, and the acceptance/rejection regions are given.

Tables C1 through C30 are arranged in the following manner. In each table, four test designs are given in which the values of P_0 and P_1 are held constant. The four designs correspond to assigning both α_0 and α_1 the values of 0.10, 0.05, 0.025, and 0.01. (Although α_0 and α_1 are assigned equal values here, this is not a requirement of the binomial sequential test design.) The comparisons of P_0 and P_1 range from P_0 = 0.10 versus P_1 = 0.20 to P_0 = 0.95 versus P_1 = 0.99. The tables are arranged in increasing order of P_1. An index provides a directory to the tables by P_0 and P_1.

In the computer printouts in the tables, the comparisons are presented as tests of simple hypotheses. It has already been explained that this is equivalent to the tests of composite hypotheses.

INDEX TO TABLES C1 THROUGH C30 BY P_0 AND P_1

Tests of $P \leq P_0$ versus $P \geq P_1$

P_0	P_1	Table
0.10	0.20	C1
0.10	0.25	C2
0.20	0.30	C3
0.30	0.40	C4
0.30	0.50	C5
0.40	0.50	C6
0.45	0.50	C7
0.45	0.55	C8
0.50	0.60	C9
0.55	0.60	C10
0.50	0.65	C11
0.50	0.70	C12
0.60	0.70	C13
0.65	0.70	C14
0.50	0.75	C15
0.60	0.75	C16
0.70	0.75	C17
0.60	0.80	C18
0.70	0.80	C19
0.70	0.85	C20
0.75	0.85	C21
0.70	0.90	C22
0.75	0.90	C23
0.80	0.90	C24
0.85	0.90	C25
0.75	0.90	C26
0.80	0.95	C27
0.85	0.95	C28
0.90	0.95	C29
0.95	0.99	C30

TABLE C1

TESTS OF P ≤ 0.10 VERSUS P ≥ 0.20

H0:P=P0= .100 (A0= .100)
H1:P=P1= .200 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	18.65
P0 = .100	0.900	47.91
P* = .145	0.500	59.18
P1 = .200	0.100	39.59
P = 1	0	3.17

N(E) <= -3.170 + 0.170 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 3.170 + 0.170 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .100 (A0= .050)
H1:P=P1= .200 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	25.00
P0 = .100	0.950	72.23
P* = .145	0.500	106.19
P1 = .200	0.050	59.68
P = 1	0	4.25

N(E) <= -4.248 + 0.170 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 4.248 + 0.170 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .100 (A0= .025)
H1:P=P1= .200 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	31.10
P0 = .100	0.975	94.86
P* = .145	0.500	164.40
P1 = .200	0.025	78.38
P = 1	0	5.29

N(E) <= -5.285 + 0.170 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 5.285 + 0.170 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .100 (A0= .010)
H1:P=P1= .200 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	39.01
P0 = .100	0.990	122.74
P* = .145	0.500	258.63
P1 = .200	0.010	101.62
P = 1	0	6.63

N(E) <= -6.629 + 0.170 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 6.629 + 0.170 * N(E') (ACCEPT H1, REJECT H0)

TABLE C2

TESTS OF P $\leq$ 0.10 VERSUS P $\geq$ 0.25

H0:P=P0= .100 (A0= .100)
H1:P=P1= .250 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	12.85
P0 = .100	0.900	24.28
P* = .166	0.500	28.90
P1 = .250	0.100	19.04
P = 1	0	2.40

N(E) <= -2.398 + 0.199 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 2.398 + 0.199 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .100 (A0= .050)
H1:P=P1= .250 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	16.15
P0 = .100	0.950	36.57
P* = .166	0.500	51.90
P1 = .250	0.050	28.70
P = 1	0	3.21

N(E) <= -3.213 + 0.199 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 3.213 + 0.199 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .100 (A0= .025)
H1:P=P1= .250 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	20.09
P0 = .100	0.975	48.03
P* = .166	0.500	80.34
P1 = .250	0.025	37.69
P = 1	0	4.00

N(E) <= -3.998 + 0.199 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 3.998 + 0.199 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .100 (A0= .010)
H1:P=P1= .250 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	25.20
P0 = .100	0.990	62.15
P* = .166	0.500	126.39
P1 = .250	0.010	48.77
P = 1	0	5.01

N(E) <= -5.015 + 0.199 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 5.015 + 0.199 * N(E*) (ACCEPT H1, REJECT H0)

TABLE C3

TESTS OF P ≤ 0.20 VERSUS P ≥ 0.30

H0:P=P0= .200 (A0= .100)
H1:P=P1= .300 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	16.45
P0 = .200	0.900	68.31
P* = .248	0.500	89.17
P1 = .300	0.100	62.40
P = 1	0	5.42

N(E) <= -5.419 + 0.329 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 5.419 + 0.329 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .200 (A0= .050)
H1:P=P1= .300 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	22.05
P0 = .200	0.950	102.98
P* = .248	0.500	160.13
P1 = .300	0.050	94.08
P = 1	0	7.26

N(E) <= -7.262 + 0.329 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 7.262 + 0.329 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .200 (A0= .025)
H1:P=P1= .300 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	27.44
P0 = .200	0.975	135.25
P* = .248	0.500	247.90
P1 = .300	0.025	123.56
P = 1	0	9.04

N(E) <= -9.035 + 0.329 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 9.035 + 0.329 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=PC= .200 (A0= .010)
H1:P=P1= .300 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	34.41
P0 = .200	0.990	175.00
P* = .248	0.500	389.99
P1 = .300	0.010	159.87
P = 1	0	11.33

N(E) <= -11.333 + 0.329 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 11.333 + 0.329 * N(E*) (ACCEPT H1, REJECT H0)

TABLE C4

TESTS OF P $\leq$ 0.30 VERSUS P $\geq$ 0.40

H0:P=P0= .300 (A0= .100)
H1:P=P1= .400 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	14.25
P0 = .300	0.900	81.38
P* = .349	0.500	108.87
P1 = .400	0.100	77.84
P = 1	0	7.64

N(E) <= -7.638 + 0.536 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 7.638 + 0.536 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .300 (A0= .050)
H1:P=P1= .400 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	19.10
P0 = .300	0.950	122.68
P* = .349	0.500	195.50
P1 = .400	0.050	117.35
P = 1	0	10.24

N(E) <= -10.235 + 0.536 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 10.235 + 0.536 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .300 (A0= .025)
H1:P=P1= .400 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	23.77
P0 = .300	0.975	161.12
P* = .349	0.500	302.66
P1 = .400	0.025	154.12
P = 1	0	12.73

N(E) <= -12.735 + 0.536 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 12.735 + 0.536 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .300 (A0= .010)
H1:P=P1= .400 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	29.81
P0 = .300	0.990	208.47
P* = .349	0.500	476.14
P1 = .400	0.010	199.41
P = 1	0	15.97

N(E) <= -15.973 + 0.536 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 15.973 + 0.536 * N(E*) (ACCEPT H1, REJECT H0)

TABLE C5

TESTS OF P ≤ 0.30 VERSUS P ≥ 0.50

H0:P=P0= .300 (A0= .100)
H1:P=P1= .500 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	6.53
P0 = .300	0.900	21.36
P* = .397	0.500	28.09
P1 .500	0.100	20.16
P = 1	0	4.30

N(E) <= -4.301 + 0.659 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 4.301 + 0.659 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .300 (A0= .050)
H1:P=P1= .500 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	8.75
P0 = .300	0.950	32.21
P* = .397	0.500	50.44
P1 = .500	0.050	30.40
P = 1	0	5.76

N(E) <= -5.764 + 0.659 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 5.764 + 0.659 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .300 (A0= .025)
H1:P=P1= .500 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	10.89
P0 = .300	0.975	42.30
P* = .397	0.500	78.09
P1 = .500	0.025	39.92
P = 1	0	7.17

N(E) <= -7.172 + 0.659 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 7.172 + 0.659 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .300 (A0= .010)
H1:P=P1= .500 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	13.66
P0 = .300	0.990	54.73
P* = .397	0.500	122.85
P1 = .500	0.010	51.66
P = 1	0	9.00

N(E) <= -8.995 + 0.659 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 8.995 + 0.659 * N(E*) (ACCEPT H1, REJECT H0)

TABLE C6

TESTS OF P $\leq$ 0.40 VERSUS P $\geq$ 0.50

H0:P=P0= .400 (A0= .100)
H1:P=P1= .500 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	12.05
P0 = .400	0.900	87.50
P* = .450	0.500	118.67
P1 = .500	0.100	86.12
P = 1	0	9.85

N(E) <= -9.847 + 0.817 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 9.847 + 0.817 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .400 (A0= .050)
H1:P=P1= .500 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	16.15
P0 = .400	0.950	131.61
P* = .450	0.500	213.10
P1 = .500	0.050	129.83
P = 1	0	13.20

N(E) <= -13.195 + 0.817 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 13.195 + 0.817 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .400 (A0= .025)
H1:P=P1= .500 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	20.09
P0 = .400	0.975	172.85
P* = .450	0.500	329.90
P1 = .500	0.025	170.52
P = 1	0	16.42

N(E) <= -16.418 + 0.817 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 16.418 + 0.817 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .400 (A0= .010)
H1:P=P1= .500 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	25.20
P0 = .400	0.990	223.65
P* = .450	0.500	519.00
P1 = .500	0.010	220.63
P = 1	0	20.59

N(E) <= -20.593 + 0.817 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 20.593 + 0.817 * N(E*) (ACCEPT H1, REJECT H0)

TABLE C7

TESTS OF P $\leq$ 0.45 VERSUS P $\geq$ 0.50

H0:P=P0= .450 (A0= .100)
H1:P=P1= .500 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	23.05
P0 = .450	0.900	350.97
P' = .475	0.500	480.76
P1 = .500	0.100	349.80
P = 1	0	20.85

N(E) <= -20.854 + 0.905 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 20.854 + 0.905 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .450 (A0= .050)
H1:P=P1= .500 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	30.89
P0 = .450	0.950	529.11
P' = .475	0.500	863.35
P1 = .500	0.050	527.34
P = 1	0	27.95

N(E) <= -27.946 + 0.905 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 27.946 + 0.905 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .450 (A0= .025)
H1:P=P1= .500 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	38.44
P0 = .450	0.975	694.91
P' = .475	0.500	1336.56
P1 = .500	0.025	692.59
P = 1	0	34.77

N(E) <= -34.772 + 0.905 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 34.772 + 0.905 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .450 (A0= .010)
H1:P=P1= .500 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	48.21
P0 = .450	0.990	899.14
P' = .475	0.500	2102.70
P1 = .500	0.010	896.13
P = 1	0	43.61

N(E) <= -43.613 + 0.905 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 43.613 + 0.905 * N(E') (ACCEPT H1, REJECT H0)

TABLE C8

TESTS OF P $\leq$ 0.45 VERSUS P $\geq$ 0.55

H0:P=P0= .450 (A0= .100)
H1:P=P1= .550 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	10.95
P0 = .450	0.900	87.60
P' = .500	0.500	119.89
P1 = .550	0.100	87.60
P = 1	0	10.95

N(E) <= -10.949 + 1.000 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 10.949 + 1.000 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .450 (A0= .050)
H1:P=P1= .550 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	14.67
P0 = .450	0.950	132.06
P' = .500	0.500	215.30
P1 = .550	0.050	132.06
P = 1	0	14.67

N(E) <= -14.673 + 1.000 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 14.673 + 1.000 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .450 (A0= .025)
H1:P=P1= .550 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	18.25
P0 = .450	0.975	173.44
P' = .500	0.500	333.30
P1 = .550	0.025	173.44
P = 1	0	18.26

N(E) <= -18.257 + 1.000 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 18.257 + 1.000 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .450 (A0= .010)
H1:P=P1= .550 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	22.90
P0 = .450	0.990	224.41
P' = .500	0.500	524.36
P1 = .550	0.010	224.41
P = 1	0	22.90

N(E) <= -22.899 + 1.000 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 22.899 + 1.000 * N(E') (ACCEPT H1, REJECT H0)

TABLE C9

TESTS OF P $\leq$ 0.50 VERSUS P $\geq$ 0.60

```
          H0:P=P0= .500      (A0= .100)
          H1:P=P1= .600      (A1= .100)
```

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	9.85
P0 = .500	0.900	86.12
P' = .550	0.500	118.67
P1 = .600	0.100	87.30
P = 1	0	12.05

```
N(E) <= -12.051 +   1.224 * N(E')      (ACCEPT H0, REJECT H1)
N(E) >=  12.051 +   1.224 * N(E')      (ACCEPT H1, REJECT H0)
```

```
          H0:P=P0= .500      (A0= .050)
          H1:P=P1= .600      (A1= .050)
```

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	13.20
P0 = .500	0.950	129.83
P' = .550	0.500	213.10
P1 = .600	0.050	131.61
P = 1	0	16.15

```
N(E) <= -16.150 +   1.224 * N(E')      (ACCEPT H0, REJECT H1)
N(E) >=  16.150 +   1.224 * N(E')      (ACCEPT H1, REJECT H0)
```

```
          H0:P=P0= .500      (A0= .025)
          H1:P=P1= .600      (A1= .025)
```

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	16.42
P0 = .500	0.975	170.52
P' = .550	0.500	329.90
P1 = .600	0.025	172.85
P = 1	0	20.09

```
N(E) <= -20.094 +   1.224 * N(E')      (ACCEPT H0, REJECT H1)
N(E) >=  20.094 +   1.224 * N(E')      (ACCEPT H1, REJECT H0)
```

```
          H0:P=P0= .500      (A0= .010)
          H1:P=P1= .600      (A1= .010)
```

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	20.59
P0 = .500	0.990	220.63
P' = .550	0.500	510.00
P1 = .600	0.010	223.65
P = 1	0	25.20

```
N(E) <= -25.203 +   1.224 * N(E')      (ACCEPT H0, REJECT H1)
N(E) >=  25.203 +   1.224 * N(E')      (ACCEPT H1, REJECT H0)
```

TABLE C10

TESTS OF P $\leq$ 0.55 VERSUS P $\geq$ 0.60

H0:P=P0= .550 (A0= .100)
H1:P=P1= .600 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	18.65
P0 = .550	0.900	341.5[illegible]
P' = .575	0.500	471.08
P1 = .600	0.100	345.09
P = 1	0	25.25

N(E) <= -25.252   1.354 * N(E')   (ACCEPT H0, REJECT H1)
N(E) >= 25.252 +   1.354 * N(E')   (ACCEPT H1, REJECT H0)

H0:P=P0= .550 (A0= .050)
H1:P=P1= .600 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	25.00
P0 = .550	0.950	514.95
P' = .575	0.500	845.95
P1 = .600	0.050	520.26
P = 1	0	33.84

N(E) <= -33.840 +   1.354 * N(E')   (ACCEPT H0, REJECT H1)
N(E) >= 33.840 +   1.354 * N(E')   (ACCEPT H1, REJECT H0)

H0:P=P0= .550 (A0= .025)
H1:P=P1= .600 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	31.10
P0 = .550	0.975	676.31
P' = .575	0.500	1309.63
P1 = .600	0.025	683.28
P = 1	0	42.10

N(E) <= -42.104 +   1.354 * N(E')   (ACCEPT H0, REJECT H1)
N(E) >= 42.104 +   1.354 * N(E')   (ACCEPT H1, REJECT H0)

H0:P=P0= .550 (A0= .010)
H1:P=P1= .600 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	39.01
P0 = .550	0.990	875.07
P' = .575	0.500	2060.32
P1 = .600	0.010	884.09
P = 1	0	52.81

N(E) <= -52.811 +   1.354 * N(E')   (ACCEPT H0, REJECT H1)
N(E) >= 52.811 +   1.354 * N(E')   (ACCEPT H1, REJECT H0)

TABLE C11

TESTS OF P $\leq$ 0.50 VERSUS P $\geq$ 0.65

H0:P=P0= .500 (A0= .100)
H1:P=P1= .650 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	6.16
P0 = .500	0.900	37.28
P' = .576	0.500	51.59
P1 = .650	0.100	38.46
P = 1	0	8.37

N(E) <= -8.375 + 1.359 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 8.375 + 1.359 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .500 (A0= .050)
H1:P=P1= .650 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	8.26
P0 = .500	0.950	56.20
P' = .576	0.500	92.65
P1 = .650	0.050	57.99
P = 1	0	11.22

N(E) <= -11.223 + 1.359 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 11.223 + 1.359 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .500 (A0= .025)
H1:P=P1= .650 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	10.27
P0 = .500	0.975	73.81
P' = .576	0.500	143.43
P1 = .650	0.025	76.16
P = 1	0	13.96

N(E) <= -13.964 + 1.359 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 13.964 + 1.359 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .500 (A0= .010)
H1:P=P1= .650 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	12.88
P0 = .500	0.990	95.50
P' = .576	0.500	225.64
P1 = .650	0.010	98.54
P = 1	0	17.51

N(E) <= -17.514 + 1.359 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 17.514 + 1.359 * N(E') (ACCEPT H1, REJECT H0)

TABLE C12

TESTS OF P ≤ 0.50 VERSUS P ≥ 0.70

H0:P=P0= .500 (A0= .100)
H1:P=P1= .700 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	4.30
P0 = .500	0.900	20.16
P* = .603	0.500	28.09
P1 = .700	0.100	21.36
P = 1	0	6.53

N(E) <= -6.530 + 1.518 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 6.530 + 1.518 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .500 (A0= .050)
H1:P=P1= .700 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	5.76
P0 = .500	0.950	30.40
P* = .603	0.500	50.44
P1 = .700	0.050	32.21
P = 1	0	8.75

N(E) <= -8.751 + 1.518 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 8.751 + 1.518 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .50) (A0= .025)
H1:P=P1= .700 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	7.17
P0 = .500	0.975	39.92
P* = .603	0.500	78.09
P1 = .700	0.025	42.30
P = 1	0	10.89

N(E) <= -10.888 + 1.518 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 10.888 + 1.518 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .500 (A0= .010)
H1:P=P1= .700 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	9.00
P0 = .500	0.990	51.66
P* = .603	0.500	122.85
P1 = .700	0.010	54.73
P = 1	0	13.66

N(E) <= -13.657 + 1.518 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 13.657 + 1.518 * N(E*) (ACCEPT H1, REJECT H0)

TABLE C13

TESTS OF P $\leq$ 0.60 VERSUS P $\geq$ 0.70

H0:P=P0= .600 (A0= .100)
H1:P=P1= .700 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	7.66
P0 = .600	0.900	77.86
P' = .651	0.500	108.87
P1 = .700	0.100	81.38
P = 1	0	14.25

N(E) <= -14.254 + 1.866 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 14.254 + 1.866 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .600 (A0= .050)
H1:P=P1= .700 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	10.24
P0 = .600	0.950	117.35
P' = .651	0.500	195.50
P1 = .700	0.050	122.68
P = 1	0	19.10

N(E) <= -19.101 + 1.866 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 19.101 + 1.866 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .600 (A0= .025)
H1:P=P1= .700 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	12.73
P0 = .600	0.975	154.12
P' = .651	0.500	302.66
P1 = .700	0.025	161.12
P = 1	0	23.77

N(E) <= -23.766 + 1.866 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 23.766 + 1.866 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .600 (A0= .010)
H1:P=P1= .700 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	15.97
P0 = .600	0.990	199.61
P' = .651	0.500	476.14
P1 = .700	0.010	208.47
P = 1	0	29.81

N(E) <= -29.809 + 1.866 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 29.809 + 1.866 * N(E') (ACCEPT H1, REJECT H0)

TABLE C14

TESTS OF P ≤ 0.65 VERSUS P ≥ 0.70

H0:P=P0= .650 (A0= .100)
H1:P=P1= .700 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	14.25
P0 = .650	0.900	303.90
P* = .675	0.500	422.61
P1 = .700	0.100	312.20
P = 1	0	29.65

N(E) <= -29.649 + 2.080 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 29.649 + 2.080 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .650 (A0= .050)
H1:P=P1= .700 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	19.10
P0 = .650	0.950	458.27
P' = .675	0.500	758.92
P1 = .700	0.050	470.66
P = 1	0	39.73

N(E) <= -39.732 + 2.080 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 39.732 + 2.080 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .650 (A0= .025)
H1:P=P1= .700 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	23.77
P0 = .650	0.975	601.88
P' = .675	0.500	1174.89
P1 = .700	0.025	618.14
P = 1	0	49.44

N(E) <= -49.435 + 2.080 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 49.435 + 2.080 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .650 (A0= .010)
H1:P=P1= .700 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	29.81
P0 = .650	0.990	778.76
P* = .675	0.500	1848.35
P1 = .700	0.010	799.81
P = 1	0	62.01

N(E) <= -62.006 + 2.080 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 62.006 + 2.080 * N(E') (ACCEPT H1, REJECT H0)

TABLE C15

TESTS OF P $\leq$ 0.50 VERSUS P $\geq$ 0.75

HO:P=PO= .500 (AO= .100)
H1:P=P1= .750 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=PO	SAMPLE SIZES
P = 0	1	3.1[illegible]
PO = .500	0.900	12.22
P* = .631	0.500	17.1[illegible]
P1 = .750	0.100	13.4[illegible]
P = 1	0	5.42

N(E) <= -5.419 + 1.710 * N(E*) (ACCEPT HO, REJECT H1)
N(E) >= 5.419 + 1.710 * N(E*) (ACCEPT H1, REJECT HO)

HO:P=PO= .500 (AO= .050)
H1:P=P1= .750 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=PO	SAMPLE SIZES
P = 0	1	4.25
PO = .500	0.950	18.42
P* = .631	0.500	30.85
P1 = .750	0.050	20.26
P = 1	0	7.26

N(E) <= -7.262 + 1.710 * N(E*) (ACCEPT HO, REJECT H1)
N(E) >= 7.262 + 1.710 * N(E*) (ACCEPT H1, REJECT HO)

HO:P=PO= .500 (AO= .025)
H1:P=P1= .750 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=PO	SAMPLE SIZES
P = 0	1	5.29
PO = .500	0.975	24.20
P* = .631	0.500	47.76
P1 = .750	0.025	26.61
P = 1	0	9.04

N(E) <= -9.035 + 1.710 * N(E*) (ACCEPT HO, REJECT H1)
N(E) >= 9.035 + 1.710 * N(E*) (ACCEPT H1, REJECT HO)

HO:P=PO= .500 (AO= .010)
H1:P=P1= .750 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=PO	SAMPLE SIZES
P = 0	1	6.63
PO = .500	0.990	31.31
P* = .631	0.500	75.13
P1 = .750	0.010	34.43
P = 1	0	11.33

N(E) <= -11.333 + 1.710 * N(E*) (ACCEPT HO, REJECT H1)
N(E) >= 11.333 + 1.710 * N(E*) (ACCEPT H1, REJECT HO)

TABLE C16

TESTS OF P $\leq$ 0.60 VERSUS P $\geq$ 0.75

H0:P=PC= .600 (A0= .100)
H1:P=P1= .750 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	6.67
P0 = .600	0.900	32.48
P* = .678	0.500	46.03
P1 = .750	0.100	35.26
P = 1	0	9.85

N(E) <= -9.847 + 2.106 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 9.847 + 2.106 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .600 (A0= .050)
H1:P=P1= .750 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	6.26
P0 = .600	0.950	48.97
P* = .678	0.500	82.66
P1 = .750	0.050	53.15
P = 1	0	13.20

N(E) <= -13.195 + 2.106 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 13.195 + 2.106 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .600 (A0= .025)
H1:P=P1= .750 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	7.79
P0 = .600	0.975	64.31
P* = .678	0.500	127.97
P1 = .750	0.025	69.81
P = 1	0	16.42

N(E) <= -16.418 + 2.106 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 16.418 + 2.106 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .600 (A0= .010)
H1:P=P1= .750 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	9.78
P0 = .600	0.990	83.22
P* = .678	0.500	201.33
P1 = .750	0.010	90.32
P = 1	0	20.59

N(E) <= -20.593 + 2.106 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 20.593 + 2.106 * N(E*) (ACCEPT H1, REJECT H0)

TABLE C17

TESTS OF P $\leq$ 0.70 VERSUS P $\geq$ 0.75

H0:P=P0= .700 (A0= .100)
H1:P=P1= .750 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	12.05
P0 = .700	0.900	274.59
P' = .725	0.500	383.80
P1 = .750	0.100	285.16
P = 1	0	31.85

N(E) <= -31.847 + 2.643 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 31.847 + 2.643 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .700 (A0= .050)
H1:P=P1= .750 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	16.15
P0 = .700	0.950	413.97
P' = .725	0.500	689.23
P1 = .750	0.050	429.90
P = 1	0	42.68

N(E) <= -42.677 + 2.643 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 42.677 + 2.643 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .700 (A0= .025)
H1:P=P1= .750 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	20.09
P0 = .700	0.975	543.69
P' = .725	0.500	1067.00
P1 = .750	0.025	564.61
P = 1	0	53.10

N(E) <= -53.101 + 2.643 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 53.101 + 2.643 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .700 (A0= .010)
H1:P=P1= .750 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	25.20
P0 = .700	0.990	703.47
P' = .725	0.500	1678.62
P1 = .750	0.010	730.54
P = 1	0	66.60

N(E) <= -66.603 + 2.643 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 66.603 + 2.643 * N(E') (ACCEPT H1, REJECT H0)

TABLE C18

TESTS OF P $\leq$ 0.60 VERSUS P $\geq$ 0.80

H0:P=P0= .600 (A0= .100)
H1:P=P1= .800 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	3.17
P0 = .600	0.900	16.80
P* = .707	0.500	24.21
P1 = .800	0.100	19.21
P = 1	0	7.64

N(E) <= -7.638 + 2.409 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 7.638 + 2.409 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .600 (A0= .050)
H1:P=P1= .800 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	4.25
P0 = .600	0.950	25.32
P* = .707	0.500	43.48
P1 = .800	0.050	28.96
P = 1	0	10.24

N(E) <= -10.235 + 2.409 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 10.235 + 2.409 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .600 (A0= .025)
H1:P=P1= .800 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	5.29
P0 = .600	0.975	33.26
P* = .707	0.500	67.31
P1 = .800	0.025	38.03
P = 1	0	12.73

N(E) <= -12.735 + 2.409 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 12.735 + 2.409 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .600 (A0= .010)
H1:P=P1= .800 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	6.63
P0 = .600	0.990	43.03
P* = .707	0.500	105.89
P1 = .800	0.010	49.21
P = 1	0	15.97

N(E) <= -15.973 + 2.409 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 15.973 + 2.409 * N(E*) (ACCEPT H1, REJECT H0)

TABLE C19

TESTS OF P $\leq$ 0.70 VERSUS P $\geq$ 0.80

H0:P=P0= .700 (A0= .100)
H1:P=P1= .800 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	5.42
P0 = .700	0.900	62.40
P' = .752	0.500	89.17
P1 = .800	0.100	68.38
P = 1	0	16.45

N(E) <= -16.455 + 3.036 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 16.455 + 3.036 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .700 (A0= .050)
H1:P=P1= .800 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	7.26
P0 = .700	0.950	94.08
P' = .752	0.500	168.13
P1 = .800	0.050	102.98
P = 1	0	22.05

N(E) <= -22.051 + 3.036 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 22.051 + 3.036 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .700 (A0= .025)
H1:P=P1= .800 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	9.04
P0 = .700	0.975	123.56
P' = .752	0.500	247.90
P1 = .800	0.025	135.25
P = 1	0	27.44

N(E) <= -27.436 + 3.036 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 27.436 + 3.036 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .700 (A0= .010)
H1:P=P1= .800 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	11.33
P0 = .700	0.990	159.97
P' = .752	0.500	389.99
P1 = .800	0.010	175.00
P = 1	0	34.41

N(E) <= -34.412 + 3.036 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 34.412 + 3.036 * N(E') (ACCEPT H1, REJECT H0)

TABLE C20

TESTS OF P $\leq$ 0.70 VERSUS P $\geq$ 0.85

H0:P=P0= .700 (A0= .100)
H1:P=P1= .850 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	3.17
P0 = .700	0.900	24.40
P* = .781	0.500	35.87
P1 = .850	0.100	28.79
P = 1	0	11.32

N(E) <= -11.317 + 3.570 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 11.317 + 3.570 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .700 (A0= .050)
H1:P=P1= .850 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	4.25
P0 = .700	0.950	36.79
P* = .781	0.500	64.42
P1 = .850	0.050	43.40
P = 1	0	15.17

N(E) <= -15.165 + 3.570 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 15.165 + 3.570 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .700 (A0= .025)
H1:P=P1= .850 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	5.29
P0 = .700	0.975	48.32
P* = .781	0.500	99.73
P1 = .850	0.025	57.00
P = 1	0	18.87

N(E) <= -18.869 + 3.570 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 18.869 + 3.570 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=PC= .700 (A0= .010)
H1:P=P1= .850 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	6.63
P0 = .700	0.990	62.51
P* = .781	0.500	156.90
P1 = .850	0.010	73.75
P = 1	0	23.67

N(E) <= -23.667 + 3.570 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 23.667 + 3.570 * N(E*) (ACCEPT H1, REJECT H0)

TABLE C21

TESTS OF P $\leq$ 0.75 VERSUS P $\geq$ 0.85

H0:P=P0= .750 (A0= .100)
H1:P=P1= .850 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	4.30
P0 = .750	0.900	51.95
P* = .803	0.500	75.51
P1 = .850	0.100	59.06
P = 1	0	17.55

N(E) <= -17.555 + 4.081 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 17.555 + 4.081 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .750 (A0= .050)
H1:P=P1= .850 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	5.76
P0 = .750	0.950	78.32
P* = .803	0.500	135.60
P1 = .850	0.050	89.03
P = 1	0	23.52

N(E) <= -23.525 + 4.081 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 23.525 + 4.081 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .750 (A0= .025)
H1:P=P1= .850 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	7.17
P0 = .750	0.975	102.87
P* = .803	0.500	209.92
P1 = .850	0.025	116.93
P = 1	0	29.27

N(E) <= -29.270 + 4.081 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 29.270 + 4.081 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .750 (A0= .010)
H1:P=P1= .850 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	9.00
P0 = .750	0.990	133.10
P* = .803	0.500	330.25
P1 = .850	0.010	151.29
P = 1	0	36.71

N(E) <= -36.713 + 4.081 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 36.713 + 4.081 * N(E*) (ACCEPT H1, REJECT H0)

TABLE C22

TESTS OF P $\leq$ 0.70 VERSUS P $\geq$ 0.90

H0:P=P0= .700 (A0= .100)
H1:P=P1= .900 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	2.00
P0 = .700	0.900	11.44
P* = .814	0.500	17.49
P1 = .900	0.100	15.11
P = 1	0	8.74

N(E) <= -8.743 + 4.371 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 8.743 + 4.371 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .700 (A0= .050)
H1:P=P1= .900 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	2.68
P0 = .700	0.950	17.25
P* = .814	0.500	31.40
P1 = .900	0.050	22.78
P = 1	0	11.72

N(E) <= -11.716 + 4.371 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 11.716 + 4.371 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .700 (A0= .025)
H1:P=P1= .900 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	3.33
P0 = .700	0.975	22.65
P* = .814	0.500	48.61
P1 = .900	0.025	29.92
P = 1	0	14.58

N(E) <= -14.578 + 4.371 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 14.578 + 4.371 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .700 (A0= .010)
H1:P=P1= .900 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	4.18
P0 = .700	0.990	29.31
P* = .814	0.500	76.48
P1 = .900	0.010	38.71
P = 1	0	18.28

N(E) <= -18.284 + 4.371 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 18.284 + 4.371 * N(E*) (ACCEPT H1, REJECT H0)

TABLE C23

TESTS OF P ≤ 0.75 VERSUS P ≥ 0.90

HO:P=PC= .750 (AO= .100)
H1:P=P1= .900 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=PO	SAMPLE SIZES
P = 0	1	2.40
PO = .750	0.900	19.06
P' = .834	0.500	28.90
P1 = .900	0.100	24.26
P = 1	0	12.05

N(E) <= -12.051 + 5.026 * N(E') (ACCEPT HO, REJECT H1)
N(E) >= 12.051 + 5.026 * N(E') (ACCEPT H1, REJECT HO)

HO:P=PO= .750 (AO= .050)
H1:P=P1= .900 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=PO	SAMPLE SIZES
P = 0	1	3.21
PO = .750	0.950	28.70
P' = .834	0.500	51.90
P1 = .900	0.050	36.57
P = 1	0	16.15

N(E) <= -16.150 + 5.026 * N(E') (ACCEPT HO, REJECT H1)
N(E) >= 16.150 + 5.026 * N(E') (ACCEPT H1, REJECT HO)

HO:P=PC= .750 (AO= .025)
H1:P=P1= .900 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=PO	SAMPLE SIZES
P = 0	1	4.00
PO = .750	0.975	37.69
P' = .834	0.500	80.34
P1 = .900	0.025	48.03
P = 1	0	20.09

N(E) <= -20.094 + 5.026 * N(E') (ACCEPT HO, REJECT H1)
N(E) >= 20.094 + 5.026 * N(E') (ACCEPT H1, REJECT HO)

HO:P=PC= .750 (AO= .010)
H1:P=P1= .900 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=PO	SAMPLE SIZES
P = 0	1	5.01
PO = .750	0.990	48.77
P' = .834	0.500	126.39
P1 = .900	0.010	62.15
P = 1	0	25.20

N(E) <= -25.203 + 5.026 * N(E') (ACCEPT HO, REJECT H1)
N(E) >= 25.203 + 5.026 * N(E') (ACCEPT H1, REJECT HO)

TABLE C24

TESTS OF P $\leq$ 0.80 VERSUS P $\geq$ 0.90

H0:P=PC= .800 (A0= .100)
H1:P=P1= .900 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=PO	SAMPLE SIZES
P = 0	1	3.17
PO = .800	0.900	39.59
P' = .855	0.500	59.19
P1 = .900	0.100	47.91
P = 1	0	18.65

N(E) <= -18.655 + 5.885 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 18.655 + 5.885 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .800 (A0= .050)
H1:P=P1= .900 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=PO	SAMPLE SIZES
P = 0	1	4.25
PO = .800	0.950	59.68
P' = .855	0.500	106.19
P1 = .900	0.050	72.23
P = 1	0	25.00

N(E) <= -24.999 + 5.885 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 24.999 + 5.885 * N(E') (ACCEPT H1, REJECT H0)

H0:P=PC= .800 (A0= .025)
H1:P=P1= .900 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=PO	SAMPLE SIZES
P = 0	1	5.29
PO = .800	0.975	78.38
P' = .855	0.500	164.40
P1 = .900	0.025	94.86
P = 1	0	31.10

N(E) <= -31.104 + 5.885 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 31.104 + 5.885 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .800 (A0= .010)
H1:P=P1= .900 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=PO	SAMPLE SIZES
P = 0	1	6.63
PO = .800	0.990	101.42
P' = .855	0.500	258.63
P1 = .900	0.010	122.74
P = 1	0	39.01

N(E) <= -39.013 + 5.885 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 39.013 + 5.885 * N(E') (ACCEPT H1, REJECT H0)

TABLE C25

TESTS OF P ≤ 0.85 VERSUS P ≥ 0.90

H0:P=P0= .850 (A0= .100)
H1:P=P1= .900 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	5.42
P0 = .850	0.900	143.67
P* = .876	0.500	208.31
P1 = .900	0.100	161.32
P = 1	0	38.44

N(E) <= -38.441 + 7.094 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 38.441 + 7.094 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .850 (A0= .050)
H1:P=P1= .900 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	7.26
P0 = .850	0.950	216.59
P* = .876	0.500	374.09
P1 = .900	0.050	243.21
P = 1	0	51.51

N(E) <= -51.514 + 7.094 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 51.514 + 7.094 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .850 (A0= .025)
H1:P=P1= .900 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	9.04
P0 = .850	0.975	284.46
P* = .876	0.500	579.13
P1 = .900	0.025	319.42
P = 1	0	64.09

N(E) <= -64.095 + 7.094 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 64.095 + 7.094 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .850 (A0= .010)
H1:P=P1= .900 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	11.33
P0 = .850	0.990	368.06
P* = .876	0.500	911.09
P1 = .900	0.010	413.29
P = 1	0	80.39

N(E) <= -80.393 + 7.094 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 80.393 + 7.094 * N(E*) (ACCEPT H1, REJECT H0)

TABLE C26

TESTS OF P $\leq$ 0.75 VERSUS P $\geq$ 0.90

H0:P=P0= .750 (A0= .100)
H1:P=P1= .950 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	1.37
P0 = .750	0.900	7.81
P* = .872	0.500	12.69
P1 = .950	0.100	12.20
P = 1	0	9.29

N(E) <= -9.295 + 6.808 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 9.295 + 6.808 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .750 (A0= .050)
H1:P=P1= .950 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	1.83
P0 = .750	0.950	11.77
P* = .872	0.500	22.79
P1 = .950	0.050	18.39
P = 1	0	12.46

N(E) <= -12.456 + 6.808 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 12.456 + 6.808 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .750 (A0= .025)
H1:P=P1= .950 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	2.28
P0 = .750	0.975	15.46
P* = .872	0.500	35.28
P1 = .950	0.025	24.15
P = 1	0	15.50

N(E) <= -15.498 + 6.808 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 15.498 + 6.808 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .750 (A0= .010)
H1:P=P1= .950 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	2.86
P0 = .750	0.990	20.01
P* = .872	0.500	55.50
P1 = .950	0.010	31.25
P = 1	0	19.44

N(E) <= -19.439 + 6.808 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 19.439 + 6.808 * N(E') (ACCEPT H1, REJECT H0)

TABLE C27

TESTS OF P $\leq$ 0.80 VERSUS P $\geq$ 0.95

H0:P=P0= .800 (A0= .100)
H1:P=P1= .950 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	1.58
P0 = .800	0.900	12.58
P* = .890	0.500	20.26
P1 = .950	0.100	18.71
P = 1	0	12.79

N(E) <= -12.786 + 8.067 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 12.786 + 8.067 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .800 (A0= .050)
H1:P=P1= .950 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	2.12
P0 = .800	0.950	18.96
P* = .890	0.500	36.39
P1 = .950	0.050	28.21
P = 1	0	17.13

N(E) <= -17.134 + 8.067 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 17.134 + 8.067 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .800 (A0= .025)
H1:P=P1= .950 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	2.66
P0 = .800	0.975	26.90
P* = .890	0.500	56.34
P1 = .950	0.025	37.05
P = 1	0	21.32

N(E) <= -21.318 + 8.067 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 21.318 + 8.067 * N(E*) (ACCEPT H1, REJECT H0)

H0:P=P0= .800 (A0= .010)
H1:P=P1= .950 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	3.31
P0 = .800	0.990	32.22
P* = .890	0.500	88.63
P1 = .950	0.010	47.94
P = 1	0	26.74

N(E) <= -26.739 + 8.067 * N(E*) (ACCEPT H0, REJECT H1)
N(E) >= 26.739 + 8.067 * N(E*) (ACCEPT H1, REJECT H0)

TABLE C28

TESTS OF P $\leq$ 0.85 VERSUS P $\geq$ 0.95

H0:P=P0= .850 (A0= .100)
H1:P=P1= .950 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	2.00
P0 = .850	0.900	25.02
P' = .908	0.500	39.51
P1 = .950	0.100	34.65
P = 1	0	19.75

N(E) <= -19.755 + 9.877 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 19.755 + 9.877 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .850 (A0= .050)
H1:P=P1= .950 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	2.68
P0 = .850	0.950	37.72
P' = .908	0.500	70.95
P1 = .950	0.050	52.23
P = 1	0	26.47

N(E) <= -26.473 + 9.877 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 26.473 + 9.877 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .850 (A0= .025)
H1:P=P1= .950 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	3.33
P0 = .850	0.975	49.54
P' = .908	0.500	109.84
P1 = .950	0.025	68.60
P = 1	0	32.34

N(E) <= -32.938 + 9.877 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 32.938 + 9.877 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .850 (A0= .010)
H1:P=P1= .950 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	4.18
P0 = .850	0.990	64.10
P' = .908	0.500	172.80
P1 = .950	0.010	88.76
P = 1	0	41.31

N(E) <= -41.313 + 9.877 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 41.313 + 9.877 * N(E') (ACCEPT H1, REJECT H0)

TABLE C29

TESTS OF P ≤ 0.90 VERSUS P ≥ 0.95

H0:P=P0= .900 (A0= .100)
H1:P=P1= .950 (A1= .100)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	3.17
P0 = .900	0.900	85.11
P' = .928	0.500	128.82
P1 = .950	0.100	105.22
P = 1	0	40.64

N(E) <= -40.639 + 12.820 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 40.639 + 12.820 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .900 (A0= .050)
H1:P=P1= .950 (A1= .050)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	4.25
P0 = .900	0.950	128.30
P' = .928	0.500	231.34
P1 = .950	0.050	158.62
P = 1	0	54.46

N(E) <= -54.459 + 12.820 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 54.459 + 12.820 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .900 (A0= .025)
H1:P=P1= .950 (A1= .025)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	5.29
P0 = .900	0.975	168.51
P' = .928	0.500	358.14
P1 = .950	0.025	208.33
P = 1	0	67.76

N(E) <= -67.759 + 12.820 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 67.759 + 12.820 * N(E') (ACCEPT H1, REJECT H0)

H0:P=P0= .900 (A0= .010)
H1:P=P1= .950 (A1= .010)

TRUE VALUE OF P	PROB ACCEPT P=P0	SAMPLE SIZES
P = 0	1	6.63
P0 = .900	0.990	218.03
P' = .928	0.500	563.42
P1 = .950	0.010	269.55
P = 1	0	84.99

N(E) <= -84.989 + 12.820 * N(E') (ACCEPT H0, REJECT H1)
N(E) >= 84.989 + 12.820 * N(E') (ACCEPT H1, REJECT H0)

TABLE C30

TESTS OF P $\leq$ 0.95 VERSUS P $\geq$ 0.99

```
                    H0:P=P0= .950      (A0= .100)
                    H1:P=P1= .990      (A1= .100)

    TRUE VALUE OF P          PROB ACCEPT P=P0          SAMPLE SIZES
      P   =   0                     1                      1.37
      P0  = .950                  0.900                   42.57
      P*  = .975                  0.500                   72.73
      P1  = .990                  0.100                   71.06
      P   =   1                     0                     53.28

  N(E) <= -53.275  +   39.023 * N(E*)       (ACCEPT H0, REJECT H1)
  N(E) >=  53.275  +   39.023 * N(E*)       (ACCEPT H1, REJECT H0)
-----------------------------------------------------------------------
                    H0:P=P0= .950      (A0= .050)
                    H1:P=P1= .990      (A1= .050)

    TRUE VALUE OF P          PROB ACCEPT P=P0          SAMPLE SIZES
      P   =   0                     1                      1.83
      P0  = .950                  0.950                   64.18
      P*  = .975                  0.500                  130.61
      P1  = .990                  0.050                  107.13
      P   =   1                     0                     71.39

  N(E) <= -71.393  +   39.023 * N(E*)       (ACCEPT H0, REJECT H1)
  N(E) >=  71.393  +   39.023 * N(E*)       (ACCEPT H1, REJECT H0)
-----------------------------------------------------------------------
                    H0:P=P0= .950      (A0= .025)
                    H1:P=P1= .990      (A1= .025)

    TRUE VALUE OF P          PROB ACCEPT P=P0          SAMPLE SIZES
      P   =   0                     1                      2.28
      P0  = .950                  0.975                   84.29
      P*  = .975                  0.500                  202.20
      P1  = .990                  0.025                  140.70
      P   =   1                     0                     88.83

  N(E) <= -88.829  +   39.023 * N(E*)       (ACCEPT H0, REJECT H1)
  N(E) >=  88.829  +   39.023 * N(E*)       (ACCEPT H1, REJECT H0)
-----------------------------------------------------------------------
                    H0:P=P0= .950      (A0= .010)
                    H1:P=P1= .990      (A1= .010)

    TRUE VALUE OF P          PROB ACCEPT P=P0          SAMPLE SIZES
      P   =   0                     1                      2.86
      P0  = .950                  0.990                  109.06
      P*  = .975                  0.500                  318.10
      P1  = .990                  0.010                  182.05
      P   =   1                     0                    111.42

  N(E) <=-111.416  +   39.023 * N(E*)       (ACCEPT H0, REJECT H1)
  N(E) >= 111.416  +   39.023 * N(E*)       (ACCEPT H1, REJECT H0)
-----------------------------------------------------------------------
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APPENDIX D

TABLES OF HYPOTHESES VERSUS SAMPLE SIZES

APPENDIX D

TABLES OF HYPOTHESES VERSUS SAMPLE SIZES

This appendix is intended to provide a quick cross-reference of the 120 hypotheses in Appendix C with their expected sample sizes. Table D1 should aid the user in his selection of a test design appropriate to his sample size restrictions.

In Table D1, the column "+able" refers to the tables of Appendix C. All sample sizes from Appendix C have been rounded up to the next integer value; e.g., the first sample size in Table D1 is 19, rounded up from 18.65 in Table C1. The maximum expected sample size occurs under P' which for these hypotheses is always very cloze or equal to $(P_0 + P_1)/2$.

TABLE D1. HYPOTHESES VERSUS SAMPLE SIZES

(Sheet 1 of 4)

Table	Hypothesized Values of P		Risks		Sample Sizes When				
	P_0	P_1	α_0	α_1	P=0	P=P_0	P=P'	P=P_1	P=1
C1	0.10	0.20	.100	.100	19	48	60	40	4
			.050	.050	25	73	107	60	5
			.025	.025	32	95	165	79	6
			.010	.010	40	123	259	102	7
C2	0.10	0.25	.100	.100	13	25	29	20	3
			.050	.050	17	37	52	29	4
			.025	.025	21	49	81	38	4
			.010	.010	26	63	127	49	6
C3	0.20	0.30	.100	.100	17	69	90	63	6
			.050	.050	23	103	161	95	8
			.025	.025	28	136	248	124	10
			.010	.010	35	175	390	160	12
C4	0.30	0.40	.100	.100	15	82	109	78	8
			.050	.050	20	123	196	118	11
			.025	.025	24	162	303	155	13
			.010	.010	30	209	477	200	16
C5	0.30	0.50	.100	.100	7	22	29	21	5
			.050	.050	9	33	51	32	6
			.025	.025	11	43	79	40	8
			.010	.010	14	55	123	52	9
C6	0.40	0.50	.100	.100	13	88	119	87	10
			.050	.050	17	132	214	130	14
			.025	.025	21	173	330	171	17
			.010	.010	26	224	519	221	21
C7	0.45	0.50	.100	.100	24	351	481	350	21
			.050	.050	31	530	864	528	28
			.025	.025	39	695	1337	693	35
			.010	.010	49	900	2103	897	44
C8	0.45	0.55	.100	.100	11	88	120	88	11
			.050	.050	15	133	216	133	15
			.025	.025	19	174	334	174	19
			.010	.010	23	225	525	225	23

TABLE D1. HYPOTHESES VERSUS SAMPLE SIZES

(Sheet 2 of 4)

Table	Hypothesized Values of P		Risks		Sample Sizes When				
	P_0	P_1	α_0	α_1	P=0	$P=P_0$	P=P'	$P=P_1$	P=1
C9	0.50	0.60	.100	.100	10	87	119	88	13
			.050	.050	14	130	214	132	17
			.025	.025	17	171	330	173	21
			.010	.010	21	221	520	224	26
C10	0.55	0.60	.100	.100	19	342	472	346	26
			.050	.050	25	515	846	521	34
			.025	.025	32	677	1310	684	43
			.010	.010	40	876	2061	885	53
C11	0.50	0.65	.100	.100	7	38	52	39	9
			.050	.050	9	57	93	58	12
			.025	.025	11	74	144	77	14
			.010	.010	13	96	226	99	18
C12	0.50	0.70	.100	.100	5	21	29	22	7
			.050	.050	6	31	51	33	9
			.025	.025	8	40	79	43	11
			.010	.010	9	52	123	55	14
C13	0.60	0.70	.100	.100	8	78	109	82	15
			.050	.050	11	118	196	123	20
			.025	.025	13	155	303	162	24
			.010	.010	16	200	477	209	30
C14	0.65	0.70	.100	.100	15	304	423	313	30
			.050	.050	20	459	759	471	40
			.025	.025	24	602	1175	619	50
			.010	.010	30	779	1849	800	63
C15	0.50	0.75	.100	.100	4	13	18	14	6
			.050	.050	5	19	31	21	8
			.025	.025	6	25	48	27	10
			.010	.010	7	32	76	35	12
C16	0.60	0.75	.100	.100	5	33	47	36	10
			.050	.050	7	49	83	54	14
			.025	.025	8	65	128	70	17
			.010	.010	10	84	202	91	21

TABLE D1. HYPOTHESES VERSUS SAMPLE SIZES

(Sheet 3 of 4)

Table	Hypothesized Values of P		Risks		Sample Sizes When				
	P_0	P_1	α_0	α_1	P=0	$P=P_0$	P=P'	$P=P_1$	P=1
C17	0.70	0.75	.100	.100	13	275	384	286	32
			.050	.050	17	414	690	430	43
			.025	.025	21	544	1067	565	54
			.010	.010	26	704	1679	731	67
C18	0.60	0.80	.100	.100	4	17	25	20	8
			.050	.050	5	26	44	29	11
			.025	.025	6	34	68	39	13
			.010	.010	7	44	106	50	16
C19	0.70	0.80	.100	.100	6	63	90	69	17
			.050	.050	8	95	161	103	23
			.025	.025	10	124	248	136	28
			.010	.010	12	160	390	175	35
C20	0.70	0.85	.100	.100	4	25	36	29	12
			.050	.050	5	37	65	44	16
			.025	.025	6	49	100	57	19
			.010	.010	7	63	157	74	24
C21	0.75	0.85	.100	.100	5	52	76	60	18
			.050	.050	6	79	136	90	24
			.025	.025	8	103	210	117	30
			.010	.010	9	134	331	152	37
C22	0.70	0.90	.100	.100	2	12	18	16	9
			.050	.050	3	18	32	23	12
			.025	.025	4	23	49	30	15
			.010	.010	5	30	77	39	19
C23	0.75	0.90	.100	.100	3	20	29	25	13
			.050	.050	4	29	52	37	17
			.025	.025	4	38	81	49	21
			.010	.010	6	49	127	63	26
C24	0.80	0.90	.100	.100	4	40	60	48	19
			.050	.050	5	60	107	73	25
			.025	.025	6	79	165	95	32
			.010	.010	7	102	259	123	40

TABLE D1. HYPOTHESES VERSUS SAMPLE SIZES

(Sheet 4 of 4)

Table	Hypothesized Values of P		Risks		Sample Sizes When				
	P_0	P_1	α_0	α_1	P=0	$P=P_0$	P=P'	$P=P_1$	P=1
C25	0.85	0.90	.100	.100	6	144	209	162	39
			.050	.050	8	217	375	244	52
			.025	.025	10	285	580	320	65
			.010	.010	12	369	912	414	81
C26	0.75	0.95	.100	.100	2	8	13	13	10
			.050	.050	2	12	23	19	13
			.025	.025	3	16	36	25	16
			.010	.010	3	21	56	32	20
C27	0.80	0.95	.100	.100	2	13	21	19	13
			.050	.050	3	19	37	29	18
			.025	.025	3	25	57	38	22
			.010	.010	4	33	89	48	27
C28	0.85	0.95	.100	.100	2	26	40	35	20
			.050	.050	3	38	71	53	27
			.025	.025	4	50	110	69	33
			.010	.010	5	65	173	89	42
C29	0.90	0.95	.100	.100	4	86	129	106	41
			.050	.050	5	129	232	159	55
			.025	.025	6	169	359	209	68
			.010	.010	7	219	564	270	85
C30	0.95	0.99	.100	.100	2	43	73	72	54
			.050	.050	2	65	131	108	72
			.025	.025	3	85	203	141	89
			.010	.010	3	110	319	183	112

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